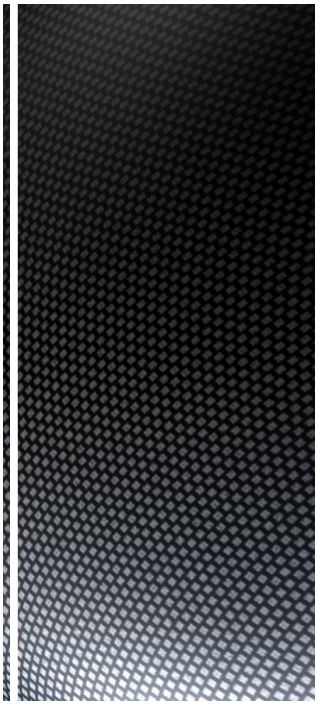


IMS

Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

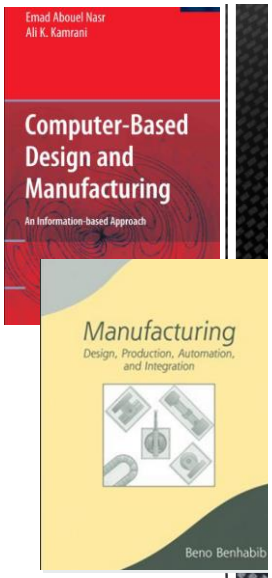
Session # 1

Course Description

- *Instructor*
  - *Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology*
  - *Email: FValilai@sharif.edu , Tel: 6616-5706*
  - *Website: Sharif.edu/~fvalilai*
- *Class time*
  - *Saturday* *13:00-15:45*
- *Course evaluation*
  - *Mid-term* *(25%)*
  - *Final exam* *(40%)*
  - *Quiz* *(5%)*
  - *Exercise* *(30%)*

Course Description *(Continued …)*

- *Mid-term session:*
  - *Saturday: 14th Azar 1394,*
- *Final Exam:*
- *Reference:*
  - *Abouel Nasr, Emad; Kamrani, Ali K.; "Computer-Based Design and Manufacturing: An Information-Based Approach", 2007, Springer, New York*
  - *Benhabib, Beno; "Manufacturing: Design, Production, CAD/CAM, and Integration", 2003, Marcel Dekker Inc, New York*



Course Description *(Continued …)*

- *Mid-term session:*
- *Final Exam:*
- *Reference:*
  - *Schaefer, D., Cloud-based Design and Manufacturing (CBDM): A Service-Oriented Product Development Paradigm for the 21st Century, . London: Springer, 2014*
  - *Koren, Y., "The Global Manufacturing Revolution", Wiley, 2010*
  - *Nasr, A., "Computer-Based Design and Manufacturing An Information-Based Approach",Springer, 2007*
  - *Mitchell, F.H., "CIM Systems: An Introduction to Computer-Integrated Manufacturing", Prentice Hall College Div; 1St Edition edition (January 1991), ISBN: 978-0131332997*

Course Description (Continued..)

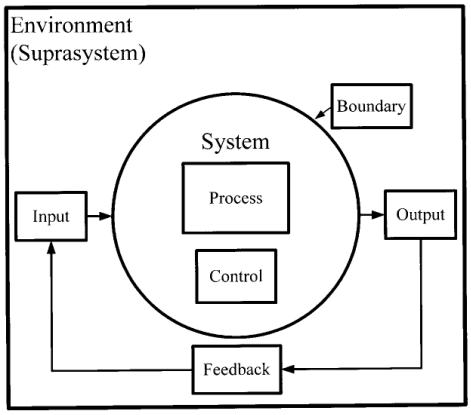
- *Contents:*
  - *Fundamentals*
  - *Computer Integrated Manufacturing*
  - *Manufacturing Communication Systems*
  - *Flexible Manufacturing and assembly systems*
  - *Components of a knowledge based systems*
  - *Machine learning*
  - *Design of mechanical parts and mechanisms*
  - *Process planning*
  - *Knowledge based systems for equipment selection*
  - *Group Technology: Models and Algorithms*
  - *KBGT*
  - *Models and algorithms for machine layout*
  - *Aggregating scheduling of machining and assembly systems*
  - *KBSS*

Foundation of Information Systems (IS)

- *Data & Information:*
  - *Data is a raw fact and can take the form of a number or statement such as date or a measurement .*
  - *Information is the data which have been processed so that they are meaningful.*
    - *Information needs the process(es) which collect(s) data and subject them to transformation process.*

Foundation of Information Systems (IS)

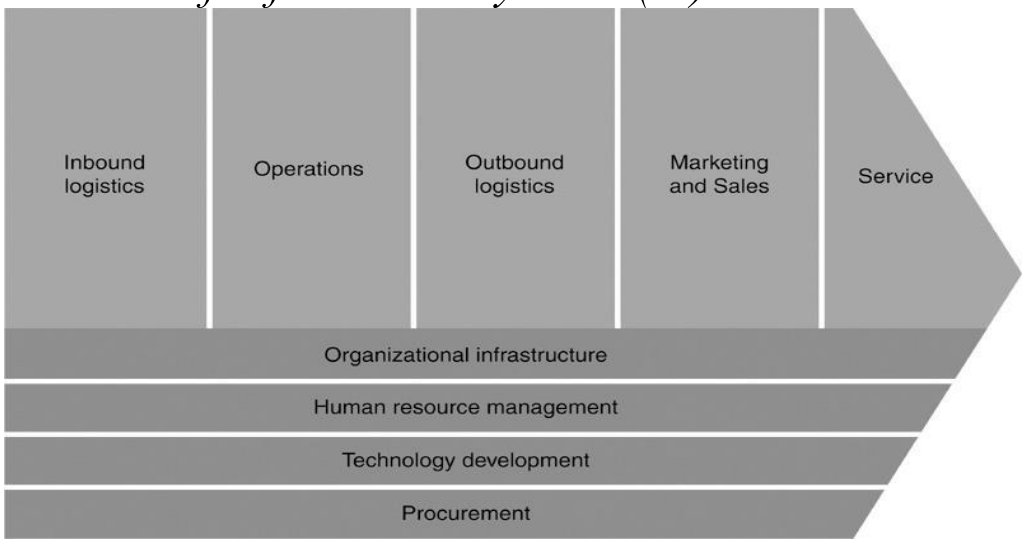
- *Information system (IS):*
  - *is a set of hardware, software, data, human, and procedural components intended to provide the right data and information to the right person at the right time.*



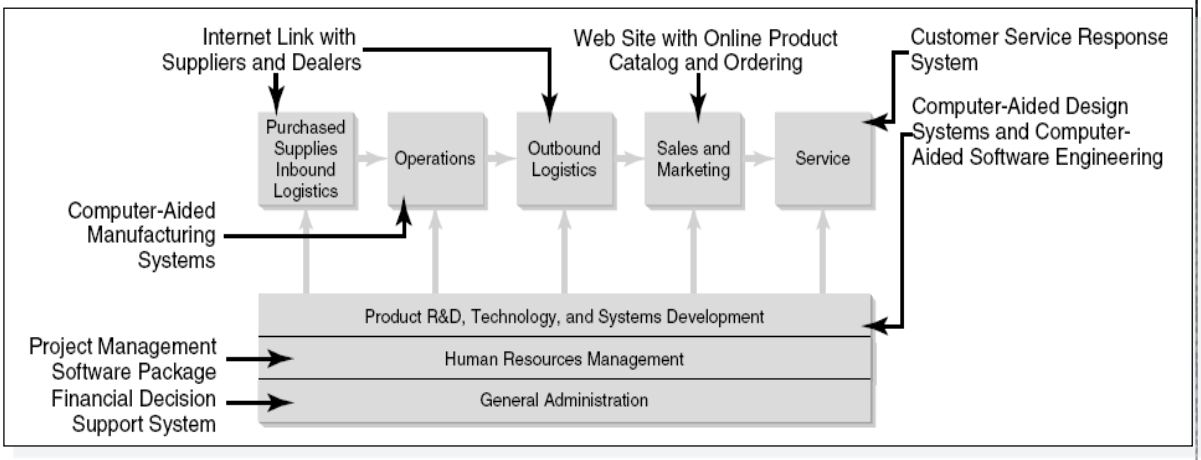
Foundation of Information Systems (IS)

- *Information system (IS):*
  - *Of the most important role of the Information systems is to provide information for management*
  - *This management enables decision making process which ensure that the organization is controlled*
  - *The organization will be in control if it is meeting the needs of the environment*

Foundation of Information Systems (IS)



Foundation of Information Systems (IS)



Foundation of Information Systems (IS)

- *Information systems may be divided into two categories of systems:*
  - *The Ones that support an organization's day-to-day business activities*
  - *Systems that support managerial decision making.*

Foundation of Information Systems (IS)

- *Types of Information Systems (IS):*
  - *Transaction Processing System (TPS) or Operations Information Systems (OIS)*
  - *Management Information Systems (MIS)*
  - *Decision Support System (DSS)*
    - *Group Decision Support System (GDSS)*
    - *Executive Support Systems (ESS) or Executive Information System (EIS)*

Foundation of Information Systems (IS)

- *Transaction Processing System (TPS) or Operations Information Systems (OIS)*
  - *TPSs support the routine, day-to-day activities that occur in the normal course of business.*
  - *TPSs often perform activities related to customer contacts – like order processing and invoicing.*
  - *The primary objective of any TPS is to capture, process, and store transactions and to produce a variety of documents related to routine business activities.*
  - *One objective of any TPS is error-free data input and processing.*

Foundation of Information Systems (IS)

- *Management Information Systems (MIS)*
  - *Management information systems (MIS) can often give firms a competitive advantage by providing the right information to the right people in the right format and at the correct time.*
  - *The primary purpose of an MIS is to help an organization achieve its goals by providing managers with insight into the regular operations of the organization so that they can*
    - *Control,*
    - *Organize, and*
    - *Plan*

    more effectively and efficiently.
  - *MIS provides managers with information, typically in reports, that support effective decision making and provides feedback on daily operations*

Foundation of Information Systems (IS)

- *Management Information Systems (MIS) perform the following functions:*
  - *Provide reports with fixed and standard formats (hard-copy and soft-copy reports)*
  - *Use internal data stored in the computer system. MIS reports use primarily internal sources of data that are contained in computerized databases.*
  - *Allow end users to develop their own custom reports*

Foundation of Information Systems (IS)

- *Management Information Systems (MIS) are used in processes like:*
  - *Financial Management Information Systems*
  - *Manufacturing Management Information Systems*
  - *Marketing Management Information Systems*
  - *Human resource Management Information Systems*

Foundation of Information Systems (IS)

- *Decision Support System (DSS):*
  - *Decision support systems offer the potential to generate higher profits, lower costs, and better products and services.*
  - *today's managers at all levels are faced with less structured, non routine problems, but the quantity and magnitude of these decisions increase as a manager rises higher in an organization.*
  - *A DSS gives the decision maker a great deal of flexibility in computer support for decision making.*
    - *What-if analysis*
    - *Goal-seeking analysis*
    - *Simulation*

Foundation of Information Systems (IS)

- *Decision Support System (DSS):*
  - *Group Decision Support Systems (GDSS)*
    - *A group decision support system (GDSS), also called group support system and computerized collaborative work system, consists of most of the elements in a DSS, plus GDSS software needed to provide effective support in group decision-making settings.*
    - *Many GDSSs allow anonymous input, where the person giving the input is not known to other group members.*
    - *One key characteristic of any GDSS is the ability to suppress or eliminate group behavior that is counterproductive or harmful to effective decision making.*
    - *GDSS software, often called groupware or workgroup software helps with joint work group scheduling, communication, and management.*

Foundation of Information Systems (IS)

- *Decision Support System (DSS):*
  - *Executive Support System (ESS) or Executive Information System (EIS)*
    - *ESS is a specialized DSS that includes all hardware, software, data, procedures, and people used to assist senior-level executives within the organization.*
    - *ESSs give top executives a means of tracking critical success factors.*
    - *ESSs are typically tailored to individual executives; DSSs are not tailored to particular users.*
    - *An ESS allows executives to drill down into the company to determine how certain data was produced.*
    - *ESSs also support strategic planning. Strategic planning involves determining long-term objectives by analyzing the strengths and weaknesses of the organization, predicting future trends, and projecting the development of new product lines.*

Foundation of Information Systems (IS)

- *Database Systems:*
  - *A database is a collection of related files.*
  - *Databases can exist on paper, for example a telephone directory.*
  - *A computer-based database offers the advantage of powerful search facilities which can be used to locate and retrieve information.*
  - *An electronic database provides facilities for users to add, amend or delete records as required.*
  - *Indexing features mean that the same basic information can be stored under a number of different categories. This provides great flexibility and allows users to locate, retrieve and organize information as needed.*

Foundation of Information Systems (IS)

- *Database Systems:*
  - *The data in an electronic database is organized by fields and records.*
  - *A field is a single item of information, such as a name or a quantity.*
  - *A record is a collection of related fields and a table is a collection of related records.*
- *Database Software*
  - *The majority of database programs support the creation of relational databases containing several linked tables.*
  - *When using database software data is retrieved from a database using what is called a query.*

Foundation of Information Systems (IS)

- *Database Software*
  - *The majority of database programs make use of a special structured query language (SQL) in order to create queries.*
  - *Structured query language (SQL) provides a standardized method for retrieving information from databases.*
  - *SQL programs are created by producing a series of statements containing special key words.*

Globalization and Manufacturing Paradigms

- *The importance of manufacturing to society*
  - *Success in such a turbulent environment requires*
    - *Having a strong base of manufacturing is important to any advanced country because it impels and stimulates all the other sectors of the economy.*
    - *It provides a wide variety of jobs, both blue- and white-collar jobs, which bring higher standards of living to many sectors in society, builds a strong middle class.*

The most important benefit to society is that manufacturing creates wealth.

Globalization and Manufacturing Paradigms

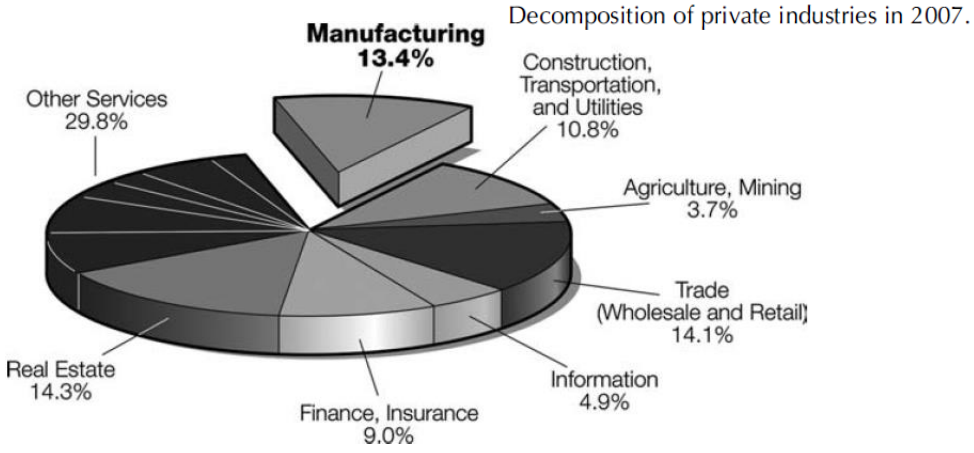
- *The importance of manufacturing to society*

Only art, agriculture, construction, and manufacturing, and more recently the software industry, create something of value from nothing.

Manufacturing still remains the largest productive sector in the overall U.S. economy.

Globalization and Manufacturing Paradigms

- *The importance of manufacturing to society*



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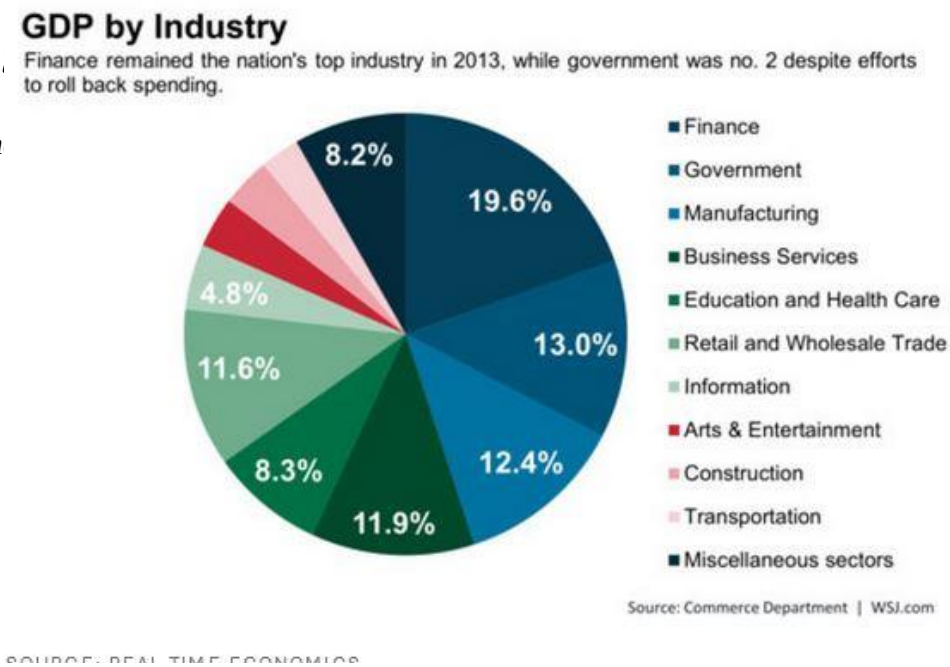

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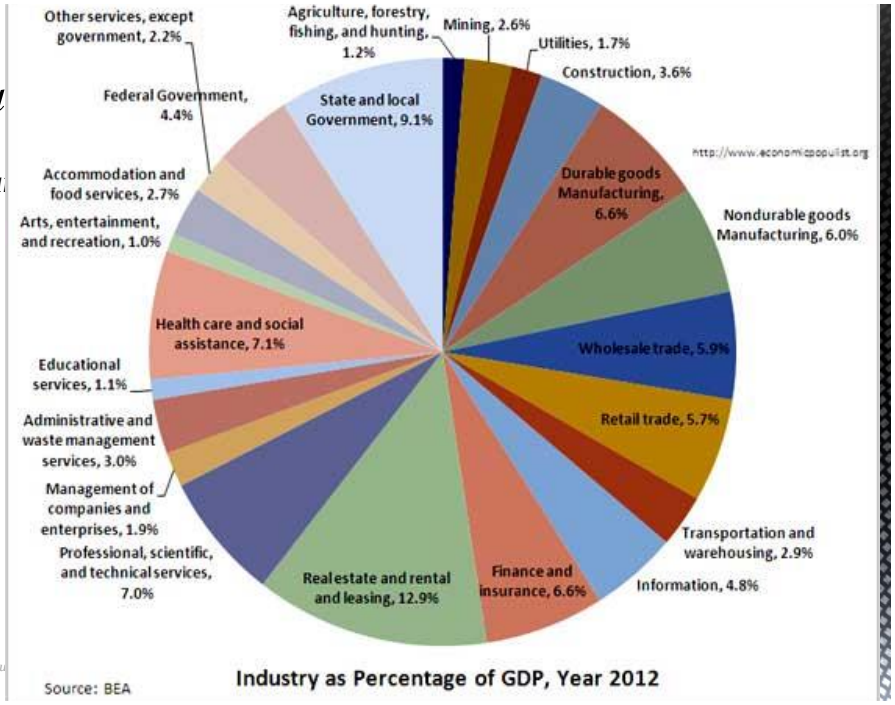


Globalization and Manufacturing Paradigms

- *Concepts:*
  - *Globalization is the integration and interdependency of world markets and resources in producing consumer goods and services*
  - *Globalization has created a new, unprecedented landscape for the manufacturing industry:*
    - *Fierce competition*
    - *Short windows of market opportunity*
    - *Frequent product introductions, and*
    - *Rapid changes in product demand.*

Globalization and Manufacturing Paradigms

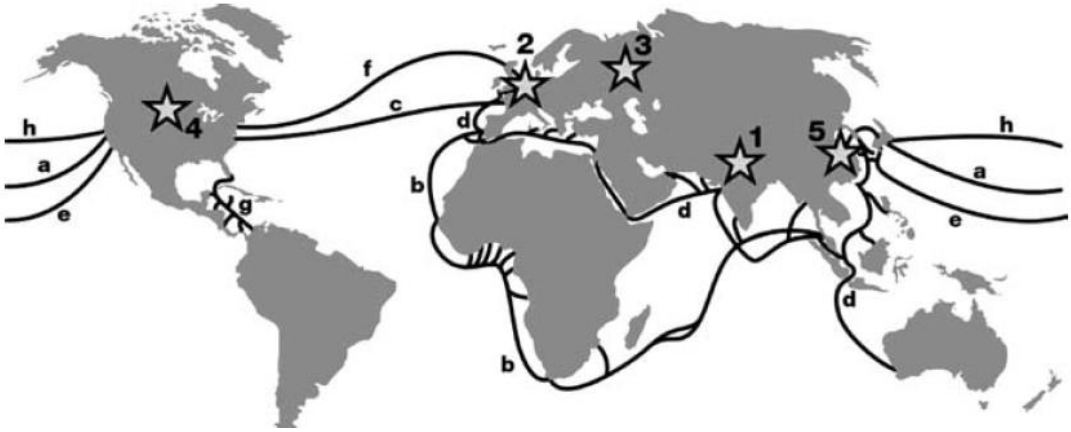
- *Concepts:*
  - *Success in such a turbulent environment requires*
    - *A global enterprise structure that can*
      - *Rapidly respond to changing markets and customer's needs.*
      - *This enterprise should be equipped with a manufacturing system that can be rapidly changed and reconfigured to respond to volatile demand.*

Globalization and Manufacturing Paradigms

Significant Events Marking a Decade of Intensified Globalization

1	1991	**India** was opened to foreign investments by "economic liberalization package," initiated by Dr. Singh, at that time India Finance Minister (he later became Prime Minister)
2	1992	The **European Union** was created
3	1992	**Russia**'s prices were freed and President Yeltsin started enterprise privatization
	1993	**Boeing** Design Center was established in Moscow with 350 engineers
4	1994	**NAFTA** (North America Free Trade Agreement—US, Canada, Mexico) was formed
	1994	**GM** decided to build engine parts in China
	1995	**Ford** India was established as a joint venture with Mahindra to assemble the Ford Escort
	1995	**Delphi** Automotive opened its first factory in China (producing batteries)
	1997	**General Motors Shanghai** (GMS) was established as a 50–50 joint venture partnership with Shanghai Automotive Industry Corp. In 2005, GMS sold 325,000 vehicles in China
	1998	**DaimlerChrysler** was formed by a merger of Daimler–Benz (the manufacturer of Mercedes–Benz, Germany) and the Chrysler Corp. (USA)
	1999	**Ford** India bought out a majority stake from Mahindra and started to produce the Ikon, Fusion, and Fiesta
5	2001	**China** joined the World Trade Organization
a–h	1992–2001	**High-capacity Transoceanic fiber-optic cable** deployments around the world

Globalization and Manufacturing Paradigms



Globalization and Manufacturing Paradigms

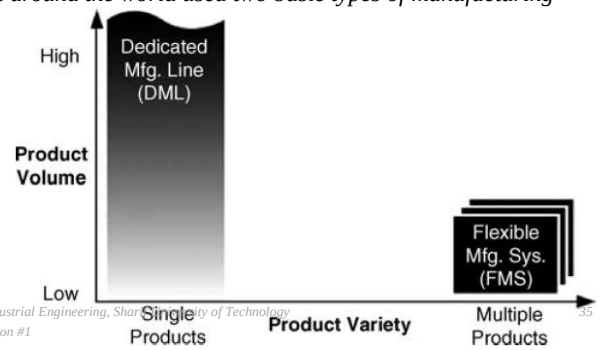
Globalization and Manufacturing Paradigms

Examples of Transoceanic Fiber-optics Cables; Frequency × 1000 Within 10 Years

	Year	Cable	Frequency
a	1992	PC-4 (Trans-Pacific cable 4), connecting United States with Japan	0.56 Gb/second
b	1993	SAT-2 connecting South Africa with West Africa Portugal, and Spain	2 Gb/second
c	1996	Trans-Atlantic (TAT) cable utilizing new fiber-optic technology	20 Gb/second
d	1998	Connecting Australia and Singapore with Germany through the Suez canal	60 Gb/second
e	1999	China–United States cable network (CUCN), over 12,000 km, connecting the U.S. West coast with China, Taiwan, Korea, and Japan	120 Gb/second
f	1999	AC-1 (Atlantic Crossing) new ring-cable, connecting New York with the UK, the Netherlands, Germany, and back to NY	160 Gb/second
g	2000	MAYA-1 connecting Costa Rica and Panama to Mexico and Florida	
h	2001	PC-1 (Pacific Crossing) Japan—U.S. West Coast	640 Gb/second

Globalization and Manufacturing Paradigms

- *The basics of manufacturing in large quantities*
  - *In a globally competitive environment, designing a cost-effective manufacturing system and operating it efficiently is a key competitive challenge especially when competitors have an advantage in countries where labor costs are substantially smaller.*
  - *At the dawn of the twenty-first century, industries around the world used two basic types of manufacturing systems:*
    - *Dedicated manufacturing lines (DMLs) and*
    - *Flexible Manufacturing Systems (FMSs).*



Manufacturing System Design

- *Computer Integrated Manufacturing*
  - *The Committee on the CAD/CAM Interface (CCCI) of the National Research Council proposes that the computer integrated manufacturing in a manufacturing enterprise occurs when:*
    - *All the processing functions and related managerial functions are expressed in the form of data.*
    - *These data are in a form that may be generated, transformed, used, moved and stored by computer technology.*
    - *These data move freely between functions in the system through out the life of the product , with the objective that the enterprise as a whole have the information needed to operate at maximum effectiveness.*

Manufacturing System Design

- *Computer Integrated Manufacturing*
  - *an alternative definition:*

The integration and automation of data, information and the control of product, from perception through production, to shipment and sup port, is referred to as Computer-Integrated Manufacturing (CIM)

Manufacturing System Design

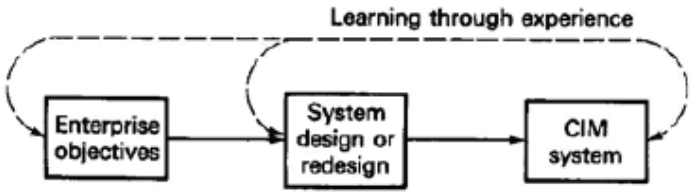
- *Computer Integrated Manufacturing*
  - *CIM as a strategy is defined to obtaining these objectives:*
  - *The purpose of manufacturing system design is to produce an enterprise that best meets stated performance objectives.*
  - *A computer-integrated manufacturing (CIM) system results when the design effort includes the use of computers to achieve an integrated flow of manufacturing activities, based on integrated information flow that links together all organizational activities.*

Manufacturing System Design

- *Computer Integrated Manufacturing*
  - *There is a danger that the "CIM equals integrated computer networks" identification will be formed.*
  - *This can lead to unfortunate results in terms of enterprise objectives.*
    - *The overall system must be rationalized, requiring that the work flow, organizational structure, and management methods be redesigned to best obtain performance objectives.*
    - *The entire meaning of product design must be assessed and modified as necessary to optimize system performance.*
    - *The most appropriate use of technology, including information flow and computers, can then be selected in this context.*

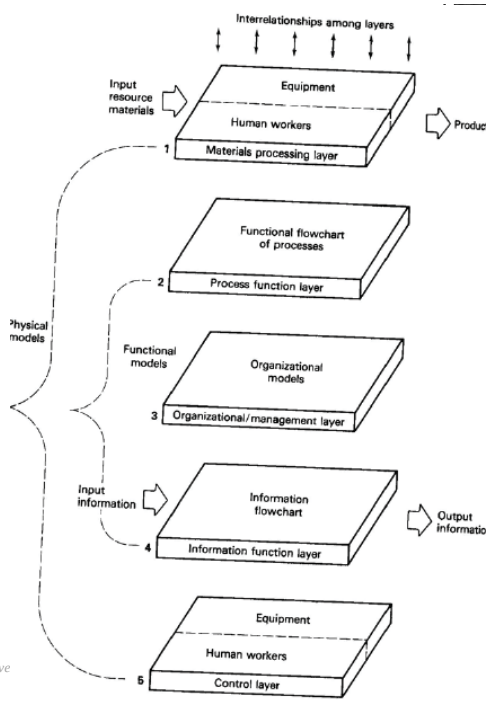
Manufacturing System Design

- *Computer Integrated Manufacturing*
  - *CIM-oriented manufacturing systems will include in formation integration obtained through computer networks.*
  - *The uses of this technology, however, will be based on system rationalization and a product design strategy that is an integrated aspect of the system*



Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*



Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Viewing the manufacturing system, an observer will see equipment and human workers that are transforming input resources into a product (layer 1),*
  - *and equipment and human workers that are providing the required control activities to operate the resource processing system (layer 5).*
  - *The equipment and workers in layer I process the resources by direct contact, where as the equipment and workers in layer 5 are not in direct contact with resource processing but function in a supporting and supervisory capacity.*
  - *Control is exerted by having layer 5 provide information to and direct the processing workers or operating equipment (layer 1).*
  - *Together layers I and 5 constitute the observable portion of the manufacturing system and determine the performance boundaries associated with the system.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *Layers 1 and 5 describe the observable part of the system and determine the physical constraints on the manufacturing activities.*
  - *However, the intelligence of the system, although not visible, is clearly a crucial aspect of facility operation.*
  - *Layer 2 may be thought of as a functional flowchart of the processes being performed by layer 1.*
  - *Layer 2 describes how the processes of layer 1 must relate to one another to transform the input resources to the desired product.*
  - *Layer 2 is thus a functional model of the desired processes, whereas layer I is the visible implementation of the related activities.*

Manufacturing System Design

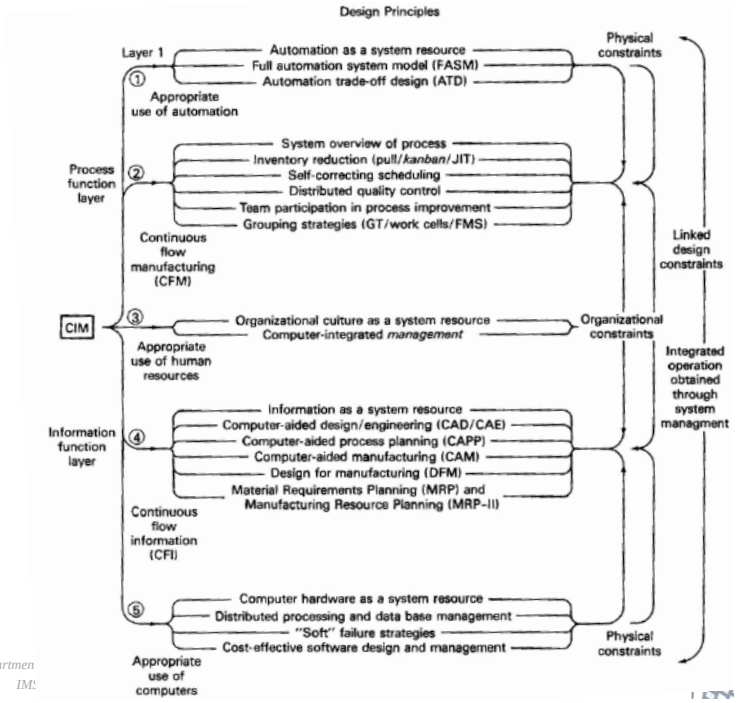
- *A Multilayer Model for the Study of Design Principles*
  - *Where layer 5 includes the physical equipment and human workers used to control the materials processing activity, layer 4 may be thought of as an information control flowchart for the system.*
  - *Where layer 2 describes the process functions necessary to manufacture a desired product, layer 4 describes the information flow that must exist to direct the desired process combination.*
  - *Layers 1 and 5 provide a complete description of the observable system; layers 2 and 4 provide a complete model of the functions and information that form the system knowledge base.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *For all manufacturing settings, the activities of workers depend on human behavior characteristics and on the organizational/management structure for the facility (layer 3).*
  - *This structure is also a non observable determinant of behavior but is of critical importance in system operation. Unless the organizational/management layer matched to the defined system, worker activities may not be consistent with the desired flowchart models.*

Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*



Manufacturing System Design

- *A Multilayer Model for the Study of Design Principles*
  - *The five-layer model can provide a useful entry into the internal study and design of manufacturing systems.*
  - *The model provides a representation that can be used to examine the system from several perspectives and to identify some of the layer trade-offs and areas of complication that can be encountered.*